PFAS

PFAS is the common descriptor for a large group of man-made chemicals that have been in the news and causing major problems around the country. I've put together a few select slides from presentations found online as well as a couple articles that hit close to home in Wisconsin. My intent is to only raise awareness and not to seek any Commission action at this time. I'm hoping this provides answers as to the who, what, and where questions that have known answers about these compounds. PFAS is on the radar screen for regulators and actions are anticipated in setting standards for the water and wastewater industry in Wisconsin. As with other emerging contaminants of concern, there is much to be learned and done before setting any limits. HOVMSD is not required to test for PFAS in influent, effluent, or biosolids in its current permit. Where exactly this issue goes is not known at this time, but it appears unlikely for concerns to disappear anytime soon.

PFAS

Select Information on who, what and where

Manufacturing History

- Complex family of more than 3,000 manmade fluorinated organic chemicals
- Produced since the mid-20th century, although not all may be currently in use or production.
- Potential health and environmental concerns, particularly for more bioaccumulative "long-chain" PFAS

Short-chain PFCAs				Long-chain PFCAs				
PFBA	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnA	PFDoA
PFBS	PFPeS	PFHxS	PFHpS	PFOS	PFNS	PFDS	PFUnS	PFDoS
Short-chain PFSAs		Long-chain PFSAs						

Table 2-1. Discovery and manufacturing history of select PFAS

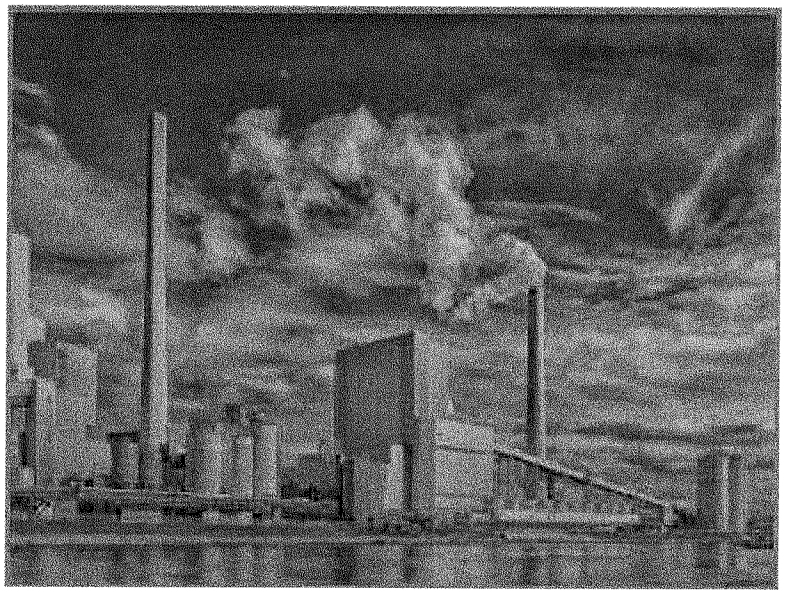
PFAS[1]	Development Time Period							
	1930s	1940s	1950s	1960s	1970s	1980s	1990s	2000s
PTFE	Invented	Non-Stick Coatings			Waterproof Fabrics			
PFOS		Initial Production	Stain & Water Resistant Products	Firefighting foam				U.S. Reduction of PFOS, PFOA, PFNA (and other select PFAS[2])
PFOA		Initial Production	Protective Coatings					
PFNA					Initial Production	Architectural Resins		
Fluoro-telomers					Initial Production	Firefighting Foams		Predominant form of firefighting foam
Dominant Process[3]		Electrochemical Fluorination (ECF)						Fluoro-telomerization (shorter chain ECF)
Pre-Invention of Chemistry /		Initial Chemical Synthesis / Production			Commercial Products Introduced and Used			

Notes:
1. This table includes fluoropolymers, PFAAs, and fluorotelomers. PTFE (polytetrafluoroethylene) is a fluoropolymer. PFOS, PFOA, and PFNA (perfluorononanoic acid) are PFAAs.
2. Refer to Section 3.4.
3. The dominant manufacturing process is shown in the table; note, however, that ECF and fluorotelomerization have both been, and continue to be, used for the production of select PFAS.

Sources: Prevedouros et al. 2006; Concawe 2016; Chemours 2017; Gore-Tex 2017; US Naval Research Academy 2017

Timeline, Production and Products

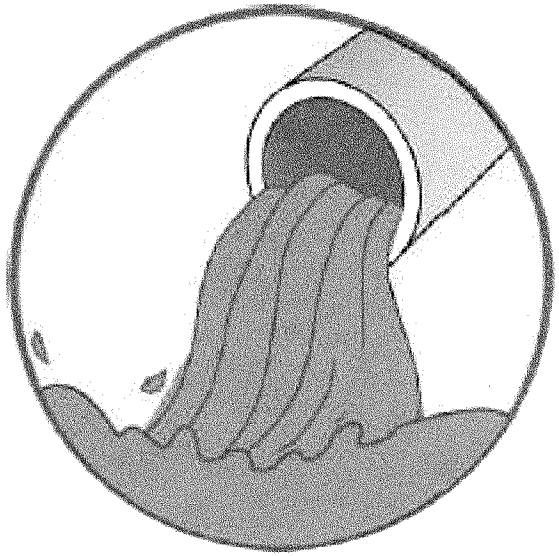
Major Sources of PFAS



1. **Aqueous Film Forming Foam**
   - Military installations
   - Civilian airports
   - Petroleum Refineries
   - Fire Fighting Training Areas
2. **Production and Manufacturing**
   - Surfactants, resins, molds, plastics
   - Textiles and leather
   - Paper products
3. **Waste Water Treatment Plants**
   - Industrial or domestic products in influent may not be treated (or may be transformed) and end up in effluent
   - Biosolids created in treatment process may contain PFAS
4. **Landfills**
   - Consumer products
   - Industrial waste
   - Biosolids from WWTP applied as cover

3. Wastewater Treatment

- Consumer and industrial use of PFAS-containing materials, including disposal of landfill leachate and firefighting foam, results in the discharge of PFAS to WWTPs.
- WWTPs, particularly those that receive industrial wastewater, are possible sources of PFAS release.



3. WWTP Operations

- Conventional sewage treatment methods do not efficiently remove PFAAs.
- Evaluation of full-scale WWTPs indicates conventional primary (sedimentation and clarification) and secondary (aerobic biodegradation of organic matter) treatment processes, can result in changes in PFAS concentrations and classes (for example, an increase in the concentrations of PFAAs in effluent, presumably from degradation of precursor PFAS).
- Some PFAS are frequently detected in WWTP effluent (for example, PFOA and PFBS), with concentrations of some PFAS ranging up to hundreds of ng/L.
- WWTP effluents are believed to be major point sources of PFAS chemicals in surface water.

3. WWTP - Biosolids

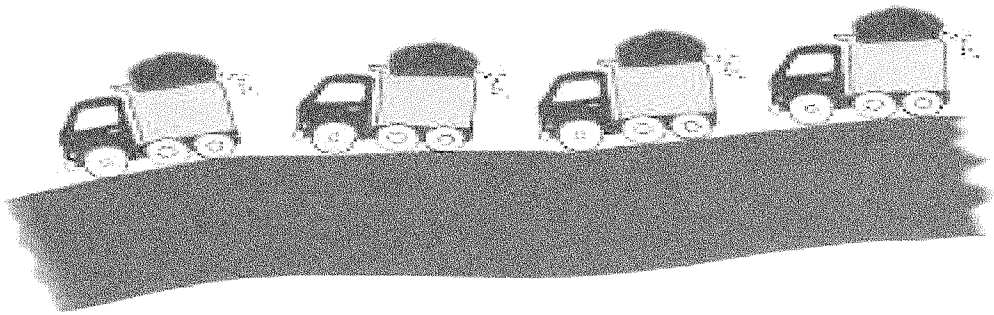
- PFAS (measured as PFCAs and PFSAs) have been found in domestic sewage sludge.
- USEPA states that more than half of the sludge produced in the United States is applied to agricultural land as biosolids, which can be a source of PFAS to the environment.
- The most abundant PFAS found in biosolids (PFOS and PFOA) are the same as in WWTP effluent; however, biosolids may also contain other long- chain PFAS.

3. WWTP - Biosolids

- Application of biosolids as a soil amendment can result in a transfer of PFAS to soil.
- These PFAS can then be available for uptake by plants and soil organisms.

4. Waste Disposal

- Leachate from some municipal solid waste landfills has been shown to be a source of PFAS release to the environment, with the presence of some PFAS reportedly due to the disposal of consumer goods treated with hydrophobic, stain- resistant coatings.
- PFAS composition and concentration in leachates vary depending on waste age, climate, and waste composition.



Commercial and Consumer Products Containing PFAS

- paper and packaging
- clothing and carpets
- outdoor textiles and sporting equipment
- ski and snowboard waxes
- non-stick cookware
- cleaning agents and fabric softeners
- polishes and waxes, and latex paints
- pesticides and herbicides
- hydraulic fluids
- windshield wipers
- paints, varnishes, dyes, and inks
- adhesives
- medical products
- personal care products (for example, shampoo, hair conditioners, sunscreen, cosmetics, toothpaste, dental floss)